

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE

		110FM04		
BLADDER ASSEMBLY, ITEM 110 ----- 0110-82829-13, -14 (1)	2/1R	External water leakage.	END ITEM: Water leakage from bladder.	A. Design - For P/N 0110-82829-13, -14: The IDB bladder assembly is fabricated from polyether polyurethane film (ST61P774-03). This material was selected for its abrasion resistance and its resistance to hydrolysis. This film has an ultimate tensile strength of 6763 psi and a tear strength of 537 lb/in. The dielectric heat sealing process is used to fabricate the bladder assembly.
DIDB ASSEMBLY, ITEM 110 ----- 0110-110110-02 (1)		IDB/DIDB: Defective Material: Heat sealing defect. Abrasion or contact with sharp object.	GFE INTERFACE: Depletion of potable water and water flowing into vent system.	The outer layers of the IDB are joined together by one-inch heat sealed sections with over-lapping ends which preclude leakage. The bladder is sealed together locally by heat sealed "dots" to provide structural support and prevent ballooning of the bag and to limit excessive loading of the seams.
OR ----- 0110-110110-01 (1)		IDB Only: Defective or damaged tubing or thread.	MISSION: Terminate EVA. CREW/VEHICLE: None with single failure. Loss of crewman with loss of SOP.	A 1/4 inch piece of silicone tubing is installed in the groove of the inlet valve housing to provide a sealing surface for the bladder material. The bladder is installed over the tubing and valve housing and secured to prevent leakage by 7-9 tight wraps of polyester thread. A surgical knot is used to terminate the thread ends. The entire wrap is coated with urethane adhesive to protect the thread and prevent loosening of the wrap. Moleskin is wrapped around the outside of the IDB Assembly at the Inlet Valve. The moleskin provides additional protection to preclude cutting of the IDB Bladder film.
			TIME TO EFFECT /ACTIONS: Seconds. The fan may be shut off in the event that an extreme leak is detected to prevent water from entering the vent return duct. After the fan has been shut off, activate purge valve and return to airlock.	The disposable IDB bladder assembly is fabricated from 4.5 mil. Polyethylene/nylon laminate film. This laminate has a yield strength of 6124 lb/sq.in and a tear propagation of 0.4 lb. (machine direction) and .91 lb/sq. in. (transverse direction). The thermal heat sealing process used to fabricate the bladder employs a "one-hit" heat seat tool for the perimeter of the bladder and a "one-hit" tool for sealing the elbow to the bladder film. The DIDB is contained within a fabric restraint which provides protection from contact with sharp objects. Items used within the EMU have a requirement to round all corners to 0.010 in. radius.
			TIME AVAILABLE: Minutes.	B. Test - For P/N 0110-82829-13, -14: Acceptance: Lot acceptance testing of all materials is performed prior to manufacturing. Heat seal seam samples are tensile tested in production to ensure structural integrity of the heat seals.
			TIME REQUIRED: Seconds.	PDA: For P/N 0110-82829-13, -14: The following tests are conducted at the IDB assembly level in accordance with ILC Document 0111-70028J: Proof pressure leakage test in restraining fixture to 2.0 (+0.1 - 0.0) psig. Leak test to verify no leakage through valve and hose assemblies or film interface.
			REDUNDANCY	DIDB: 1. Proof press/leakage tested to 2.2 psid. 2. Visually inspected to verify no leakage through valve or bladder. Certification: For P/N 0110-82829-13, -14: The following usage, reflecting requirements of significance to the IDB, was

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SCREENS:
 A-PASS
 B-PASS
 C-PASS

documented during certification:

The IDB was cycled 144 times representing 6 equivalent life years against the S/AD requirement of 144 cycles to achieve the six year operational usage.

P/N 0110-82829-13:

The assembly was tested to the S/AD ultimate pressure of 2.7 + 0.1 psid for 2 minutes. The IDB was capacity tested to the S/AD limit of 21 ounces at 1.35 +/- .1 psid.

P/N 0110-82829-14:

The assembly was tested to the S/AD ultimate pressure of 2.7+/- 0.1 psid for 2 minutes. The IDB was capacity tested to the S/AD limit of 32 ounces at 1.35+/- 0.1 psid.

DIDB Assembly:

The DIDB was successfully tested (manned) during certification to duplicate a single usage (with safety factor). (Ref. Cert. Test Report for the DIDB, ILC Doc. 0111-712763). The DIDB assembly successfully passed S/AD Requirements including 64 actuations of the valve assembly to ensure proper operation.

Requirements	S/AD	ACTUAL
Fill Cycles (using water)	1	2
Drain cycles (Bite Valve Actuation)	32	64
Installation/Removal into Restraint	1	2
Don/Doff	1	2

C. Inspection -

Components and materials manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the materials received are as identified in the procurement documents, that no damage has occurred during shipment and that supplier certifications have been received which provide traceability information.

Polyurethane seam samples for IDBs are made from the same lot and production tooling that will be used during manufacturing. The samples are then tensile tested to a minimum peel strength of 12 lbs./in.

Seam samples for DIDBs are made from the same lot and production tooling that will be used during manufacturing. The samples are then tensile tested to a minimum peel strength of 12 lbs./in.

During PDA, the following MIPs are performed at the IDB/DIDB assembly level in accordance with ILC Document 0111-70028J (IDB) and 0111-710112 (DIDB):

1. Visual inspection for material degradation or damage.
2. Verification of successful leakage test completion.

D. Failure History -

IDB:

P/N 0110-82829-12 (Obsolete Configuration) and previous bladder assemblies:

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		110FM04		<p>J-EMU-110-004 (07/21/82) - Small cut in bag. Unidentified handling anomaly. J-EMU-110-005 (07/21/82) - Small cut in bag. Unidentified handling anomaly. J-EMU-110-A001 (09/02/82) - Small puncture in bag. Revised maintenance procedures and test fixture. J-EMU-110-007 (03/22/83) - Small cut in bag. Revised field handling instructions. J-EMU-110-009 (09/18/85) - Small opening rear heat seal. Evidence of crystallization. B-EMU-110-A001 (12/24/86) - Pin hole in bladder, external leakage. No corrective action taken.</p> <p>B-EMU-110-A003 (7/18/88) - External water leakage from lower heat seal dot. Added microscopic heat seal inspection for production and field units per ECO 881-0635. Preflight microscopic inspection of heat seal dots/seams per ECO 881-0635-5.</p> <p>B-EMU-110-A006 (8/31/89) - Stress lines observed around a heat seal dot when the bag was inflated to 1.0 psi in an unrestrained condition. The stress lines disappeared when the bag was deflated. Per CCBD G6189 and ECO 901-0434, an IDB restraining fixture will be implemented during the IDB pressure test.</p> <p>I-EMU-110-A003 (5/25/90) - Leakage noted at top of HUT side of Insuit Drink Bag bladder due to two parallel cracks in bladder film. The initiation site and cause of cracks could not be determined. No corrective action was taken.</p> <p>B-EMU-110-A013 (12/16/97) - Water leaked through bladder from a small hole below bite valve cover covered by Velcro. Cause was induced trauma during Velcro adhesive debonding/rebonding or peeling back of Velcro to remove/install bite valve. Pre-flight leak test revised to submerge entire bladder surface under water including area under Velcro.</p> <p>B-EMU-110-T003 (02/27/98) - During donning of the HUT, the IDB was punctured. Investigation revealed that the bio-med harness became pinned between the IDB and crewmember during suit donning. EVA checklist was revised to ensure the bio-med harness is lifted out of the HUT during donning.</p> <p>B-EMU-100-A014 (5/6/99)- Polyurethane bladder film cracked in In-Suit Drink Bag Assembly in heat seal, just under Velcro, near the drink tube. Failure caused by exposure of the IDB to MEK while under stress. Per CCBD H7009, the standard repair procedure (SRP) in the Baseline Maintenance Manual will be amended to use urethane adhesive instead of MIK for activation of adhesive layers during the bonding process. The CCBD also adds an enhanced inspection after the final cure in the SRP and Work Instructions.</p> <p>DIDB: None.</p> <p>E. Ground Turnaround - P/N 0110-82829-13, -14: During ground turnaround in accordance with FEMU-R-001 the IDB is subjected to structural and leakage tests and visual inspection for material damage or degradation. The DIDB is not subjected to ground turn around, since it is a</p>

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		110FM04		disposable item. F. Operational Use - P/N 0110-82829-13, -14: Crew Response - Pre/post-EVA : Troubleshoot problem, if no success, replace IDB/DIDB. If no replacement, EMU no-go for EVA. EVA : If significant amounts of water detected, deactivate fan, open purge valve, terminate EVA. Special Training - Standard EMU training covers this failure mode. Operational Considerations - Flight rule A15.1.2-2 of "Space Shuttle Operational Flight Rules", NSTS-12820 defines go/no go criteria related to EMU ventilation flow. Generic EVA Checklist, JSC-48023, procedures Section 3 (EMU Checkout) and 4 (EVA prep) verify hardware integrity and systems operational status prior to EVA. Real Time Data System allows ground monitoring of EMU systems.

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-110 IN-SUIT DRINK BAG (IDB)
CRITICAL ITEM LIST (CIL)
EMU CONTRACT NO. NAS 9-97150

Prepared by:
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Approved by: 2/26/02
NASA - SSA/SSM

HS - Reliability

5/4/02
NASA - SSA/SSM

4/24/02
HS - Engineering Manager

5/24/02
NASA - S&MA

see attachment
NASA - MOD

6/4/02
NASA - Crew

6/30/02
NASA - Program Managers

EXTRAVEHICULAR MOBILITY UNIT
 SYSTEMS SAFETY REVIEW PANEL REVIEW
 FOR THE
 I-110 IN-SUIT DRINK BAG (IDB)
 CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: *[Signature]*
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